POPULATION EXPLOSIONS

Linear or Exponential Growth?

EXAMPLE: *Students.* If a population were to increase linearally, it would grow at a constant rate. For example, if your class size increased at the linear rate of 2 students per year, at the end of 5 years, there would be 2 times 5, or 10 new students.

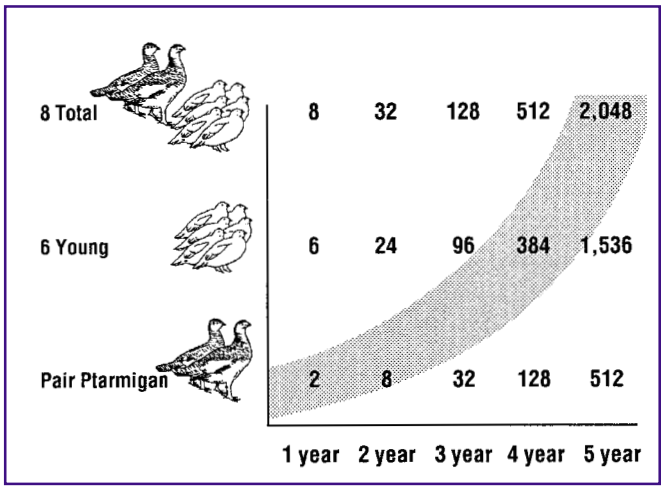
If, however, the number of students in your classroom increased **exponentially**, each year there could be two new students for each existing student. A class of 25 students would add 50 new students the first year. In the second year the 25 original and 50 new students (75 total) would increase by 150 new students. Those 225 students would grow to 675 and then to 2025 by the fifth year. **Exponential growth occurs at an increasing rate through time.**

Potential Rates

Most animal populations grow at an exponential rate because each female has the **potential** to give birth to more than one offspring in each generation. Thus, the number of females ultimately determines how fast the population can grow.

EXAMPLE: P*tarmigan.* A pair could nest and raise 6 chicks in one year. The next year, if half of the chicks were female and all survived, the 3 chicks and the original female would each raise 6 chicks, 3 of which would be female who would, in turn, each raise 6 chicks.

At the end of two years, *assuming no deaths occurred*, the original population of 2 would have grown to 32. After 3 years there would be 128, in 5 years there would be 2,048, and after 9 years this imaginary ptarmigan population would have grown to include over a million birds.



Actual Rates

The larger the population is, the faster it grows. The faster it grows, the larger the population becomes. Although all animal populations have the potential to grow at an exponential rate, the actual **growth rate** for each species varies because each has a different pattern of births. The pattern or rate of births is influenced by:

(1) the time between generations
(2) the length of gestation (pregnancy)
(3) the number of young born each time a female gives birth
(4) the age at which a female first gives birth
(5) the average reproductive life of females.

- Female red-backed voles produce 4 - 8 young up to 6 times each year and give birth to their first young at 3 - 6 weeks of age. In one year, one female red-backed vole can give birth to 24 - 48 young. That's a lot of voles!

- In contrast, humpback whales produce 1 calf every 2 years and begin breeding at 6 to 12 years old.

Factor in Deaths

In reality, animal populations do not grow as rapidly as their reproductive rate would predict because deaths occur. The size of a population at any point is a result of both births and deaths.

For example, a biologist surveys a moose population each winter. The change in the size of the population from one winter to the next is a result of both the number of calves that were born into the population and the number of adults and young that died.